



# Uintah Engineering & Land Surveying

85 SOUTH 200 EAST  
VERNAL, UTAH 84078

PHONE (801) 789-1017

NELSON J. MARSHALL  
PHONE 789-0272

LAWRENCE C. KAY  
PHONE 789-1125

ROBERT L. KAY  
PHONE 789-0493

March 28, 1997

Norman Haslam  
Ziegler Chemical & Mineral Corporation  
Little Bonanza  
Bonanza, UT 84008

Re: Engineering analysis of partial removal of surface pillar for the Cowboy-Bandana Mine plan at Gilsonite Lease U-0122693.

Dear Mr. Haslam

On March 26, 1997 Uintah Engineering & Land Surveying was asked by Robert E. Covington on Ziegler's behalf, to provide documentation supporting the plan to mine gilsonite from the surface (leaving a 10 foot pillar between the new mining operations and deeper operations completed in the past) and backfilling the excavation, providing future surface stability and final reclamation.

The plan presented by Mr. Covington to mine from the surface to a maximum depth of 30 feet presumes that ore will be found and can economically be removed to this depth. It is possible that ore vein may become too narrow to be removed. In this case, the ore will not be mined the full 30 feet but will be removed as far as it will be economical. Our analysis assumes that the full 30 feet will be mined.

There is one area where the pillar from the bottom of the proposed excavation to the top of the prior mining operation could be 10 feet in thickness. The past mining operations below this pillar terminated when the gilsonite vein narrowed (to less than 18" wide) to a point where it was no longer feasible to mine it. This means that the side walls (rock) were as close as 18" from one another. It is assumed that this vein has a wider deposit near the surface of the ground that narrows near the pillar. The bottom of this proposed excavation will terminate where the vein narrows. We propose pouring a concrete floor in the bottom of this excavation on top of the 10 foot rock/gilsonite pillar. This will distribute concentrated stresses that may occur from backfilling. The proposed concrete floor will rest upon the rock and gilsonite pillar and will be



poured between and rest upon the rock sidewalls.

Where the ore pillar is greater than 10 feet in depth the width of the ore vein is not known and will not be known until the excavation and mining occurs. In this area there may be a wider ore vein, but there will also be a deeper pillar left in place. In these areas we also propose a concrete floor to be placed at the bottom of the proposed excavation.

Because much of the prior mining reached upward as the vein narrowed, until mining upward was not feasible, the structure at the top of the existing excavation is in an "arch" shape. The arch shape of the remaining rock side walls has the structural property of transferring much of the downward force of the backfill to the side walls, thus reducing the possibility of caving. In addition, this narrowed portion of the gilsonite vein also provides resistance to caving from above. The narrowing of the vein from above will reduce the stress caused by the weight of the backfill on the gilsonite pillar.

Because some settling of the backfill will occur, we recommend that the backfill be mounded approximately 2 foot high over the filled trench to accommodate this settlement and provide a more uniform final surface.

There is little concern about surface loads over the backfilled excavation. Surface loads on the backfilled trench will have a minimal effect (compared to the weight of the backfill) on the pillar at this 30 foot depth. For example, a 15,000 pound wheel would be distributed through the fill and produce a stress of approximately 150 pounds per square foot on the top surface of the pillar.

#### CONSTRUCTION PROPOSAL:

When the gilsonite ore is mined out, one of the following rehabilitation plans will be executed.

##### Plan A

Plan A assumes that the ore was not mined any deeper than 10' from the ground surface.

- A1. The mined out vein will be backfilled with rock and earth from the surface by pushing the material into the hole with a cat. The top 2' of material should be well graded material free of large stone rubble.
- A2. A berm will be made over the top of the trench (except for areas where natural drainages cross the backfill) to compensate for the backfill material settling. The berm should be approximately 2' high and as wide as the ore vein excavation.
- A3. The surface will then be re-seeded.
- A4. Additional maintenance of the re-seeded area may be necessary to insure that vegetation grows in at least as well as the natural vegetation.



B?

?

### Plan B

Plan A assumes that the ore was not mined deeper than 10' and less than 20' deep from the ground surface.

- B1. The miners will remove any man-made objects from the mined-out vein this includes all cables, tools, unused shores, planking etc.
- B2. The floor of the ore vein will be prepared by distributing rubble piles laterally. All large void spaces due to rubble piles will be removed.
- B3. (2) #4 bars will be placed along the vein 3" off from the floor. Rubble stones will be used to hold the bars up as needed.
- B4. The floor of the vein will then be capped with 12" deep concrete over the rebars. The concrete will be allowed to cure for a minimum of 28 days.
- B5. The mined out vein will then be backfilled with rock and earth from the surface by pushing the material into the hole with a cat. The top 2' of material should be well graded material free of large stone rubble.
- B6. A berm will be made over the top of the trench (except for areas where natural drainages cross the backfill) to compensate for the backfill material settling. The berm should be approximately 2' high and as wide as the ore vein excavation.
- B7. The surface will then be re-seeded.
- B8. Additional maintenance of the re-seeded area may be necessary to insure that vegetation grows in at least as well as the natural vegetation.

continuous?

### Plan C

- 1. The miners will remove any man-made objects from the mined-out vein this includes all cables, tools, unused shores, planking etc.
- 2. The floor of the ore vein will be prepared by distributing rubble piles laterally. All large void spaces due to rubble piles will be removed.
- 3. (2) #4 bars will be placed along the vein 3" off from the floor. Rubble stones will be used to hold the bars up as needed.

4. The floor of the vein will then be capped with 24" deep concrete over the rebars. The concrete will be allowed to cure for a minimum of 28 days.
5. The mined out vein will then be backfilled with rock and earth from the surface by pushing the material into the hole with a cat. The top 2' of material should be well graded material free of large stone rubble.
6. A berm will be made over the top of the trench (except for areas where natural drainages cross the backfill) to compensate for the backfill material settling. The berm should be approximately 2' high and as wide as the ore vein excavation.
7. The surface will then be re-seeded.
8. Additional maintenance of the re-seeded area may be necessary to insure that vegetation grows in at least as well as the natural vegetation.

If you have any questions or comments, or if I can provide further information, please contact me at (801) 789-1017.

Sincerely,

*Harold Marshall*

Harold Marshall, P.E.  
Civil Engineer, U.E.L.S., Inc.



HNM/dgw